

Appl. No. 09/965,998
Amdt. dated August 27, 2004
Reply to Office action of July 1, 2004

Amendments to the Specification:

Please replace paragraph [0001] with the following amended paragraph:

[0001] This application is related to application Serial No. 09/966,064, ~~(Att'y. Docket No. 1662-41100)~~ entitled "Reserved ROM Space for Storage of Operating System Drivers," filed September 28, 2001 ~~concurrently herewith~~.

Please replace paragraph [0003] with the following amended paragraph:

[0003] The various embodiments of the present invention ~~relates generally relate to~~ loading operating systems on computer or server systems. More particularly, the ~~preferred embodiments of the present invention~~ are directed to ~~insuring~~ ensuring the availability of operating system drivers during the operating system installation process. ~~More particularly still, the preferred embodiments of the present invention are directed to storing operating system drivers in unreserved ROM and making these drivers available during the installation of the operating system.~~

Please replace paragraph [0023] with the following amended paragraph:

[0023] The main memory array 12 preferably couples to the host bridge logic 14 through a memory bus 16, and the host bridge logic 14 preferably includes a memory control unit (not shown) that controls transactions to the main memory 12 by asserting the necessary control signals during memory accesses. The main memory 12 functions as the working memory for the CPUs 10 and generally includes a ~~conventional~~ memory device or array of memory devices in which program instructions and data are stored. The main memory array 12 may comprise any suitable type of memory such as Dynamic Random Access Memory (DRAM) or any of the various types of DRAM devices such as Synchronous DRAM (SDRAM), Extended Data Output DRAM (EDO DRAM), or Rambus™ DRAM (RDRAM).

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Please replace paragraph [0024] with the following amended paragraph:

[0024] Inasmuch as computer system 100 is preferably a server system, the computer system 100 may not have a dedicated display device. If the computer system ~~did have~~ has a dedicated display device, such a system could be implemented by coupling a video driver card to the host bridge 14 by way of an Advanced Graphics Port bus or other suitable type of bus. Alternatively, the video driver card could couple to the primary expansion bus 18 or one of the secondary expansion buses, for example, the PCI bus 20. If the computer system ~~had~~ has a dedicated display device, the video driver or graphic controller would couple to a display device. That display may comprise any suitable electronic display device upon which any image or text can be represented.

Please replace paragraph [0029] with the following amended paragraph:

[0029] The preferred embodiments of the present invention address how to provide operating system drivers during the operating system installation process. In particular, the preferred embodiments of the present invention provide necessary operating system drivers by placing or storing those drivers in the ROM or firmware hub 26. Preferably, ~~required or needed~~ operating system drivers may ~~simply be~~ copied from those versions resident in the system ROM 26 during the operating system installation procedure.

Please replace paragraph [0030] with the following amended paragraph:

[0030] In computer systems requiring high availability and reliability, e.g., server systems, ~~it is common to have multiple copies of the BIOS firmware or programs~~ may be stored in the system ROM 26. Figure 2 shows a prior art technique for having multiple copies that simply involves burning two copies of the BIOS programs onto the ROM 26. In particular, Figure 2 shows two copies of the BIOS, with the first copy occupying the first 512 kilobytes of the ROM, and the second copy occupying the second 512 kilobytes of the one megabyte ROM. As ~~one of ordinary skill in the art is aware, most computer and server systems have a~~ A smaller ROM known as a "boot-block" ROM (not shown) that is responsible for

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selecting which of the multiple copies of the BIOS will be loaded during the POST procedure.

Please replace paragraph [0036] with the following amended paragraph:

[0036] ~~While there may be many ways to implement making the operating system drivers stored on the ROM 26 available during the operating system installation procedure, the Applicants now endeavor to describe the preferred method.~~ Making the operating system drivers available has three aspects that may be used alone or in combination in the preferred embodiment: 1) providing the latest drivers for each major operating system; 2) making those drivers available to the user during installation of the operating system by use of a virtual disk drive; and 3) providing those operating system drivers in a virtual drive scheme with the system drivers residing in RAM.

Please replace paragraph [0037] with the following amended paragraph:

[0037] As discussed in the Background section, there are many available operating systems for computers in the marketplace, e.g., Linux (manufactured by Red Hat Software), Novell (manufactured by Novell Incorporated), Windows 2000 (manufactured by Microsoft Inc.). For a particular piece of hardware in the system, e.g., an array controller 50 (Figure 1), each operating system may require a different driver. This may be due in part to differences in protocols with regard to interfacing with the operating system, but may also be caused merely by differences in file structures between operating systems. Stated otherwise, a driver for operating an array controller 50 in a Windows 2000 environment (FAT file system) may not be suitable for use in a Linux environment (2 x 72 file system). Thus, in the preferred embodiment, if drivers need to be included on the system ROM 26, preferably drivers for each of the major operating systems are provided. Considering that there may be an array of devices for which the latest operating system driver may be provided, ~~it is easily seen that the amount of~~ space on the ROM 26 required to store each driver for each hardware system may become rather large. In this regard, the implementation shown in Figure 4

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for dividing the ROM 26 into a redundant 30 and non-redundant 32 portion is the preferred implementation.

Please replace paragraph [0041] with the following amended paragraph:

[0041] ~~While there may be many ways to make the particular operating system drivers available during the operating system installation process, in the preferred embodiments, these drivers~~ Drivers are made available to the user and to the operating system installation procedure by having them reside on a virtual floppy drive or virtual disk drive. More particular, in the preferred embodiment, the Interrupt 13h BIOS calls for performing disk drive activities are preferably implemented such that the operating system drivers (either all of them or just the appropriate drivers for the particular operating system) stored on the ROM 26 appear to reside on a disk drive. Because the files are not actually stored on a floppy disk, this is known as creating a virtual drive. As mentioned above, the user preferably selects in a BIOS setup screen which operating system is to be installed on the computer system, and based on that selection, preferably only the drivers appropriate for the selected operating system are made available in this virtual drive method. ~~One of ordinary skill in the art is familiar with Interrupt 13h BIOS calls, how to implement them, and now understanding how to provide drivers in this way, could modify the standard programs to provide this virtual drive feature.~~

Please replace paragraph [0042] with the following amended paragraph:

[0042] More particularly still, in the preferred embodiment, selecting a particular operating system to be installed preferably sets an environment variable in a non-volatile memory. This non-volatile memory could be non-volatile RAM (NVRAM), or may be written directly to the ROM 26, which in the preferred embodiment is electrically erasable programmable read only memory (EEPROM). Regardless of the location of the environment variables, by selecting an operating system, the environment variables preferably point to a floppy image having operating system drivers appropriate for that operating system. During the installation process,

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before the operating system is installed, disk services are provided by the BIOS. Thus, during installation, the Interrupt 13h services preferably are adapted to show the appropriate operating system drivers, indicated by the environment variables, as residing on a disk drive. Thus, drivers needed for correct setup during the operating system installation process are then available as if they had been copied to a floppy and inserted in a disk drive in the system. Using the preferred embodiment alone, it is then possible to provide the operating system drivers during the operation system installation process by informing the installation program of the need to use drivers different than those provided with the operating system, and pointing that operating system software to the virtual drive. ~~However, now understanding how to make available software drivers in the manner of the preferred embodiment, one of ordinary skill in the art could easily modify the~~ The installation program ~~to could also~~ automatically search for and use drivers resident on virtual drives with little or ~~not no~~ user input.

Please replace paragraph [0046] with the following amended paragraph:

[0046] The above discussion is meant to be illustrative of the principles and various embodiments of the present invention. Numerous variations and modifications will become apparent to those skilled in the art once the above disclosure is fully appreciated. For example, the preferred embodiments have been described with regard to placing the operating system drivers on the same ROM as the BIOS programs; however, the ROM provided in the computer system could be a ROM array comprising several individual ROM devices, and the operating system software could reside on any or all of the ROM devices, and still be within the contemplation of this invention. Further, providing operating system drivers in the manner described herein was developed in the context of server systems having multiple microprocessors and multiple hard drives implementing RAID systems; however, ~~one of ordinary skill in the art, now understanding how to implement and use the preferred embodiments, could easily apply the preferred embodiments~~ could also be applied to stand alone computer systems having only a single microprocessor and single hard drive. Further, the systems

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and methods described herein are equally applicable to most computing devices such as hand-held computing devices, portable computers, process control systems, and the like. It is intended that the following claims be interpreted to embrace all such variations and modifications.

Please replace the Abstract with the following amended paragraph:

~~The invention is a~~ A method and related structure for providing operating system drivers during installation of the operating system, where those operating system drivers are provided by way of a virtual disk drive. Basic input/output system (BIOS) routines are adapted to support showing these operating system drivers as residing on a virtual disk drive within the system. The operating system drivers are stored in the unreserved ROM space of the computer. Further, multiple floppy images are stored in the ROM, and the BIOS is adapted to show only the floppy image appropriate for the operating system to be installed. The virtual drive contents may be those operating system drivers stored in the unreserved ROM, but also may be physically stored in RAM.